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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Vedder Price, PC 875 15th Street, NW Suite 725 Washington, DC 20005				
EXAMINER				
GOFF II, JOHN L				
ART UNIT		PAPER NUMBER		
1791				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/581,500

Applicant(s)

OKADA, MASUAKI

Examiner

John L. Goff

Art Unit

1791

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 April 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-5,7,9-16,18-20,22-26,28-34 and 36-42 is/are pending in the application.
- 4a) Of the above claim(s) 9-11,13,19,20,22-26,28-34 and 36-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-5,7,12,14-16,18 and 40-42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 June 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-846)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. This action is in response to the amendment filed on 4/16/09.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Specification

3. The disclosure is objected to because of the following informalities: The specification includes multiple statements referring to particular claims these statements should be removed.

Appropriate correction is required.

4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

5. The abstract of the disclosure is objected to because the abstract is more than 150 words and compares the invention with the prior art. Correction is required. See MPEP § 608.01(b).

Drawings

6. Figures 6A to 6C should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not

accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

7. Claims 1, 3-5, 7, 12, 14-16, 18, and 40-42 are objected to because of the following informalities:

In claim 1, line 12 delete "a subjecting the surfaces of both said objects to be bonded to" for clarity.

In claim 1, line 13 delete "radicals," and insert therein - - radicals - - for clarity.

In claim 1, line 15 delete "means," and insert therein - - means - - for clarity.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1, 3, 12, 15, 18, 40, and 41 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Suga et al. (U.S. Patent Application Publication 2005/0173057).

Suga discloses a bonding method for bonding objects comprising Si, SiO₂, etc. to be bonded together in a solid phase after subjecting bonding surfaces of the objects to be bonded to a hydrophilic treatment using a plasma comprising a surface activation step of performing the hydrophilic treatment by means of a plasma treatment means (Figure 2) for changing an ion strike force. Suga teaches a physical treatment step (Figure 3) of subjecting both the objects to be bonded to a physical treatment using the plasma having a strong ion strike force with oxygen as a reaction gas thereby etching surfaces of the objects to be bonded and replacing surface molecules of the surfaces with OH groups which strike and adhere to the surfaces in a first half of the plasma treatment (Figure 7 and Paragraphs 0045-0049 and 0059). Suga then teaches a chemical treatment step (Figures 4 and 5) of subjecting both the objects to be bonded to a chemical treatment using active Nitrogen radicals or active Nitrogen ions having a weak ion strike force of the plasma of which the ion strike force is reduced by means of the plasma treatment means in a second half of the plasma treatment after the physical treatment step (Figure 8 and Paragraphs 0050-0054 and 0060). Suga then teaches after the surface activation step the step of heating both the objects while the surfaces of both said objects are in contact at a temperature of 100 °C for seven hours (Figure 9 and Paragraphs 0056-0057, 0061, and 0121). The step of heating taught by Suga is an alternative embodiment that appears to be expressly disclosed for use with the embodiment of Figures 6-9. In the event it is considered that Suga

does not expressly describe the step of heating with the embodiment in Figures 6-9 the following applies. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the embodiment in Figures 6-9 including bonding at normal/room temperature taught by Suga with the alternative embodiment suggested in paragraph 0121 teaching bonding at 100 °C for seven hours as the alternative embodiment is specifically suggested as alternative for the embodiments of bonding at room temperature and bonding with a step of heating achieves a strength exceeding 27.3 MPa.

As to the limitation of “thereby covalently bonding both said objects to be bonded together through covalent bonds between bonding surfaces of both said objects”, it is acknowledged that Suga does not teach covalent bonds between the objects. Further, Suga appears to depict room/normal temperature bonding as resulting in hydrogen bonding (Figure 9). However, Suga includes all of the steps specifically taught by applicants specification as resulting in covalent bonding, i.e. plasma with oxygen gas having a strong ion strike force followed by plasma with nitrogen having a weak ion strike force followed by heating at less than 500 °C. Applicant specification suggests heating at 100 °C or less when using nitrogen and oxygen results in firm bonding (Specification page 58) wherein firm bonding is considered covalent bonding. Furthermore, applicants Figure 14 demonstrates bonding strengths of the instant invention with strengths ranging from 5 to 9 MPa depending upon the particular gases used and temperature for bonding wherein the bond strength for covalent bonding is higher than that of hydrogen bonding as in the prior art at a heating temperature of 100 °C. Suga teaches the heating step results in a bond strength of 27.3 MPa a value much higher than those in Figure 14. Thus, in view of the above it is considered that Suga must inherently teach the step of “thereby

covalently bonding both said objects to be bonded together through covalent bonds between bonding surfaces of both said objects". Finally, because Suga is performing the same as that disclosed in applicants specification it appears that if Suga does not form covalent bonds a 35 USC 112 first paragraph issue may arise.

Regarding claim 12, Suga teaches the plasma treatment means for changing the ion strike force comprises a first and a second low-pressure plasma emitting means (111, 121, 130, 140, and 210 of Figure 2) each of which emits a low-pressure plasma having a different ion strike force and means for switching (300 of Figure 2) between the first and second low-pressure plasma emitting means. Suga teaches a power supply is applied to an object-to-be-bonded holding electrode (130 and 140 of Figure 3) of the first low-pressure plasma emitting means in the first half of the plasma treatment to generate a low-pressure plasma thereby performing a plasma treatment for performing the physical treatment, and in the second half of the plasma treatment, the first low-pressure plasma emitting means is switched to the second low-pressure plasma emitting means (111 and 121) which traps plasma ions generated in another room (the space between 111 and 121) and emits radicals, thereby reducing the ion strike force so that a plasma treatment for promoting the chemical treatment is performed.

Regarding claim 18, the substrates 800a and 800b are considered wafers.

Claim Rejections - 35 USC § 103

11. Claims 4, 7, 5, 14, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suga in view of Chen et al. (U.S. Patent Application Publication 2006/0032582).

Suga is described above in full detail.

Regarding claims 4 and 7, Suga is silent as to performing the plasma treatments in a vacuum. However, it was known in the art similar to that of Suga in performing plasma treatment of surfaces of silicon substrates using oxygen gas, nitrogen gas, etc. to perform the plasma treatment under vacuum to regulate the pressure within the plasma chamber and/or evacuate gases from the chamber as shown by Chen (Paragraph 0028). It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the plasma treatments taught by Suga in a vacuum as shown by Chen for regulating the pressure within the plasma chamber and/or evacuating gases from the chamber, e.g. evacuating the chamber after the physical treatment step and before the chemical treatment step to remove the oxygen gas and/or applying vacuum throughout both plasma treatments to regulate the pressure within the chamber considered without exposure to atmospheric air.

Regarding claims 5 and 14, Suga is silent as to introducing before or during the chemical treatment a gas containing H₂O, H, OH, or O groups. It was known in the art similar to that of Suga in performing a plasma treatment of surfaces of silicon substrates using nitrogen gas to activate the surfaces of the substrates to include oxygen gas and/or water vapor to ensure the surface of the substrates are hydrated, i.e. OH groups applied thereto, as shown by Chen (Paragraphs 0026, 0027, 0031, 0032, and 0034). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the chemical treatment using nitrogen gas taught by Suga either of oxygen gas or water vapor as shown by Chen to ensure the surface of the substrates are hydrated.

Regarding claim 42, Suga is not limited to any particular substrate and suggest silicon, silicon dioxide, etc. It was known in the art similar to that of Suga to use silicon, silicon dioxide,

glass, etc. as shown by Chen (Paragraph 0047). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use as the substrates in Suga any of those known in the art for use in the same manner including silicon, silicon dioxide, glass, etc. as shown by Chen only the expected results being achieved.

12. Claims 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suga in view of Katada et al. (U.S. Patent 5,383,993).

Suga is described above in full detail. Suga is silent as to heating the substrates by applying a voltage between the substrates. It was known in the art similar to that of Suga to heat the substrates by either of heating a chamber (Figure 1(c)) or applying a voltage between the substrates (Figure 2(c)) as shown by Katada. It would have been obvious to one of ordinary skill in the art at the time the invention was made to heat the substrates as taught by Suga using either of a heated chamber or applying a voltage between the substrates as shown by Katada only the expected results being achieved.

Response to Arguments

13. Applicant's arguments with respect to claims 1, 3-5, 7, 12, 14-16, 18, and 40-42 have been considered but are moot in view of the new ground(s) of rejection.

The previous 35 USC 112 rejections are withdrawn in view of applicants amendment and arguments submitted 4/16/09. The previous rejections over Nagakubo et al. (U.S. Patent 5,421,953) are withdrawn in view of applicants arguments submitted 4/16/09.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **John L. Goff** whose telephone number is **(571)272-1216**. The examiner can normally be reached on M-F (7:15 AM - 3:45 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on (571) 272-1226. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John L. Goff/
Primary Examiner, Art Unit 1791